

**JUNE
1978**

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BOVINGTON **TANK BATTLE GAME**





The General Instrument AY-3-8710 integrated circuit is a 625 line interlaced "TV Tank Battle Game" for two players. The "battleground" consists of white barriers and a series of black mines. There is one white and one black tank, each controlled by two single pole double throw paddle switches biased to centre off. A push button for each player controls gun firing and a push button allows the battle to be reset. Pin 22 of the i.c. is switched to control the tank traps. In the open position the tanks can drive through these barriers, in the other position (grounded) the tanks halt when they collide with them. Motor sounds are provided for each tank as well as gun fire and shell explosions, and the score is coded to each tank. The tanks are driven like real tracked vehicles, pushing both switches forward causes the tank to go forward. If the switches are held the tank automatically speeds up after a few seconds. If the switches are released the tank continues at the speed reached at the time of release. Pulling both switches back causes the tank to reverse, while holding one switch back and one forward causes the tank to rotate. To stop the tank when it is going forward momentary selection of reverse is required. The shell has a range of about two thirds of the screen and after firing there is a reload period before you can fire again. The shell can be steered during its flight by rotating the tank. The shell will pass over the mines but will explode on hitting barriers. A hit on your opponent counts one point, while running over a mine counts one against you. When one player reaches 16 hits the scores flash to show that the game has ended.

Circuit Description

The circuit diagram is shown in Fig. 3. T1 provides 12-0-12 volts which is full wave rectified by D1 and D2 and smoothed by C1. IC1 regulates the supply VP to approximately 6.5 volts, VR1 adjusting the voltage and C2, 3 and 4 providing decoupling. IC4 a and b provide the 4 MHz clock to the AY-3-8710, L1 being adjustable to allow the oscillator to be set to the correct frequency. IC3 a and b, with their

associated Rs and Cs, provide the shaping for the fire and explosion sounds. IC3c does the same for the motor sounds which are all fed via IC3d to the output transistors TR1 and TR2. Switches S4, 5 and 6 control the left tank and S7, 8 and 9 control the right tank. S3 is the game reset and S2 is the tank trap switch. R2 to R4 mix the video signals and the composite video is buffered by the emitter follower TR3 and fed to the modulator.

TR4 and its associated components act as the modulator which runs at a frequency of approximately 160-170MHz, with harmonics extending into the u.h.f. band.

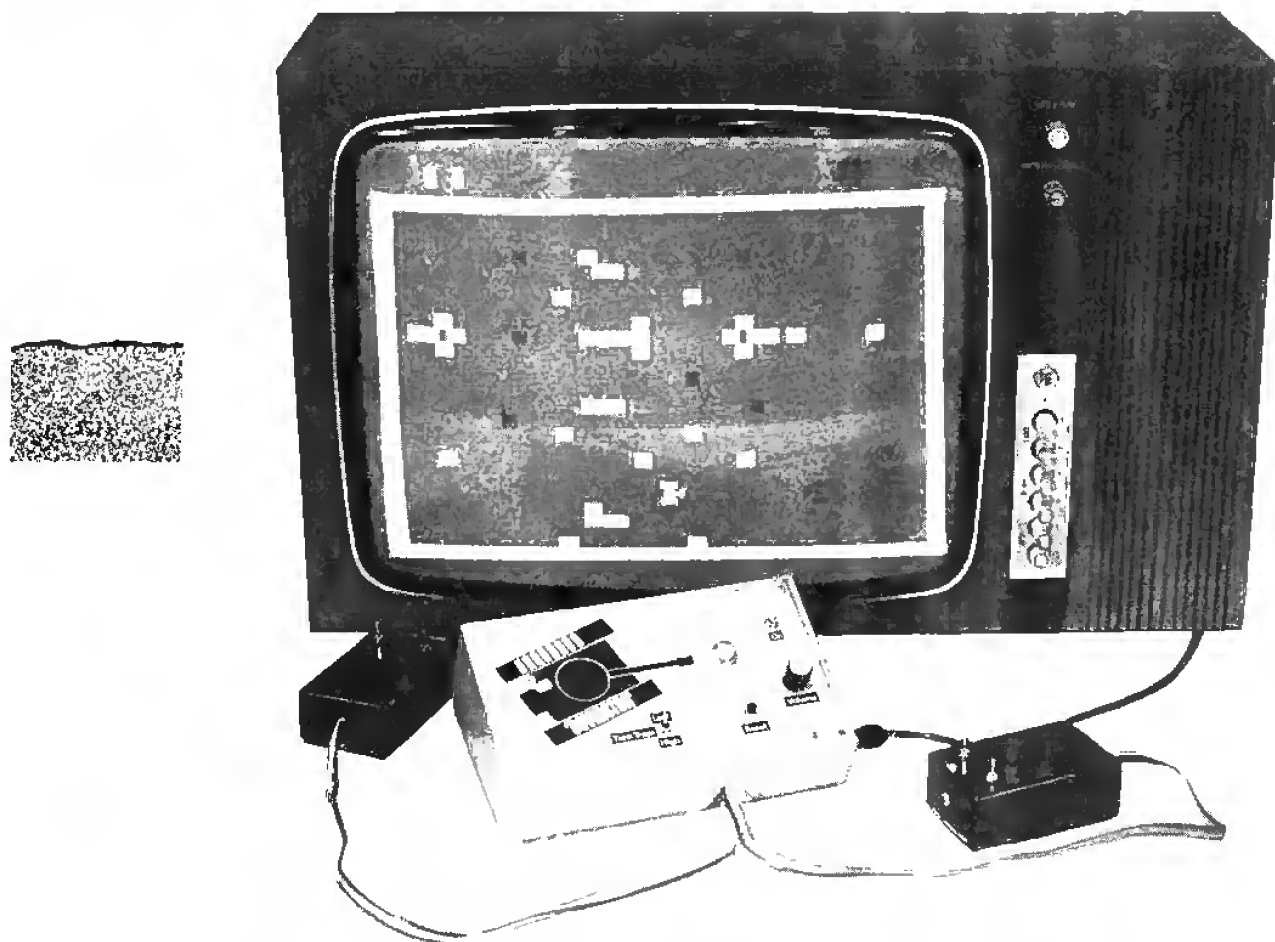
Construction

Construction is relatively straightforward, most of the components being mounted on the p.c.b. It is, however, advisable to use sockets for IC2, 3 and 4. The component layout is shown in Fig. 7. Drill 6BA clearance holes for board fixing, FS1, T1 and IC1, and a 6mm hole for L1. Drill other holes to suit the component leads. Before mounting any components on the board place the p.c.b. in the box with a modulator at the front right, and the p.c.b. about 10mm from the right side of the case. Drill 4 fixing holes in the bottom of the case using the p.c.b. as a template. Also drill a 6mm hole in the bottom to line up with L1 core. Put the p.c.b. to one side and drill the box and front panel as shown in Fig. 1. Also drill a few 6mm holes in the base and rear of the case for ventilation. Stick a small piece of speaker cloth over the rear of the speaker hole on the front panel, fix the speaker in place with epoxy adhesive and mount the switches S1, 2 and 3. The sound output is controlled by VR3 which is mounted on the front panel.

Assemble the p.c.b. using the layout Fig. 7 and parts list as a guide but do not fit IC2, 3 or 4 into their sockets yet. R9 can be either a 20M Ω resistor or two 10M Ω resistors (R9a and R9b). Fit a T05 heatsink to TR2, cut and bend a piece of aluminium sheet 60mm x 35mm as a heatsink for TR1 as shown in Fig. 4, drilling through the p.c.b., and retaining IC1 and the heatsink with a 6BA screw. Cut and bend

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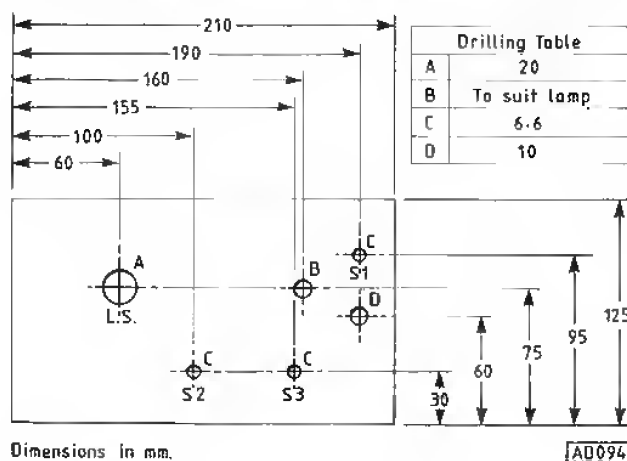
BATTLE GAME



a piece of tinplate (cocoa tin) as shown in Fig. 5 to form a box for the modulator screening, fit the sides and bottom by soldering to four Veropins as shown in the drawing but leave the top plate off until the

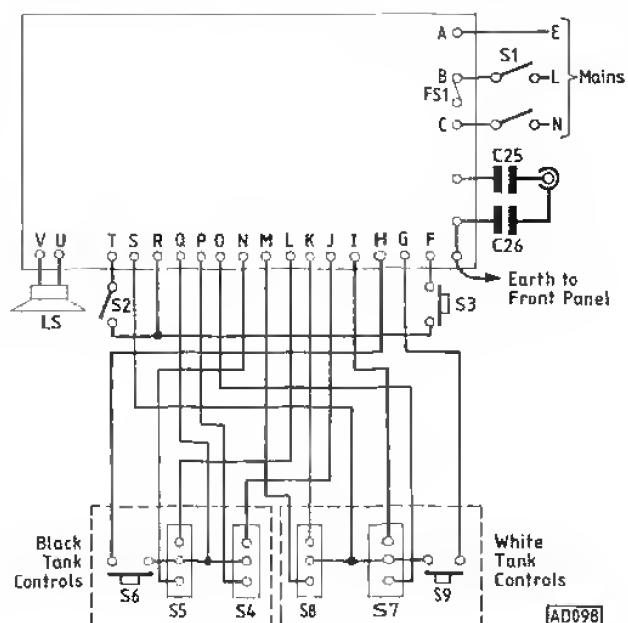
unit is working and displaying a picture on the television screen.

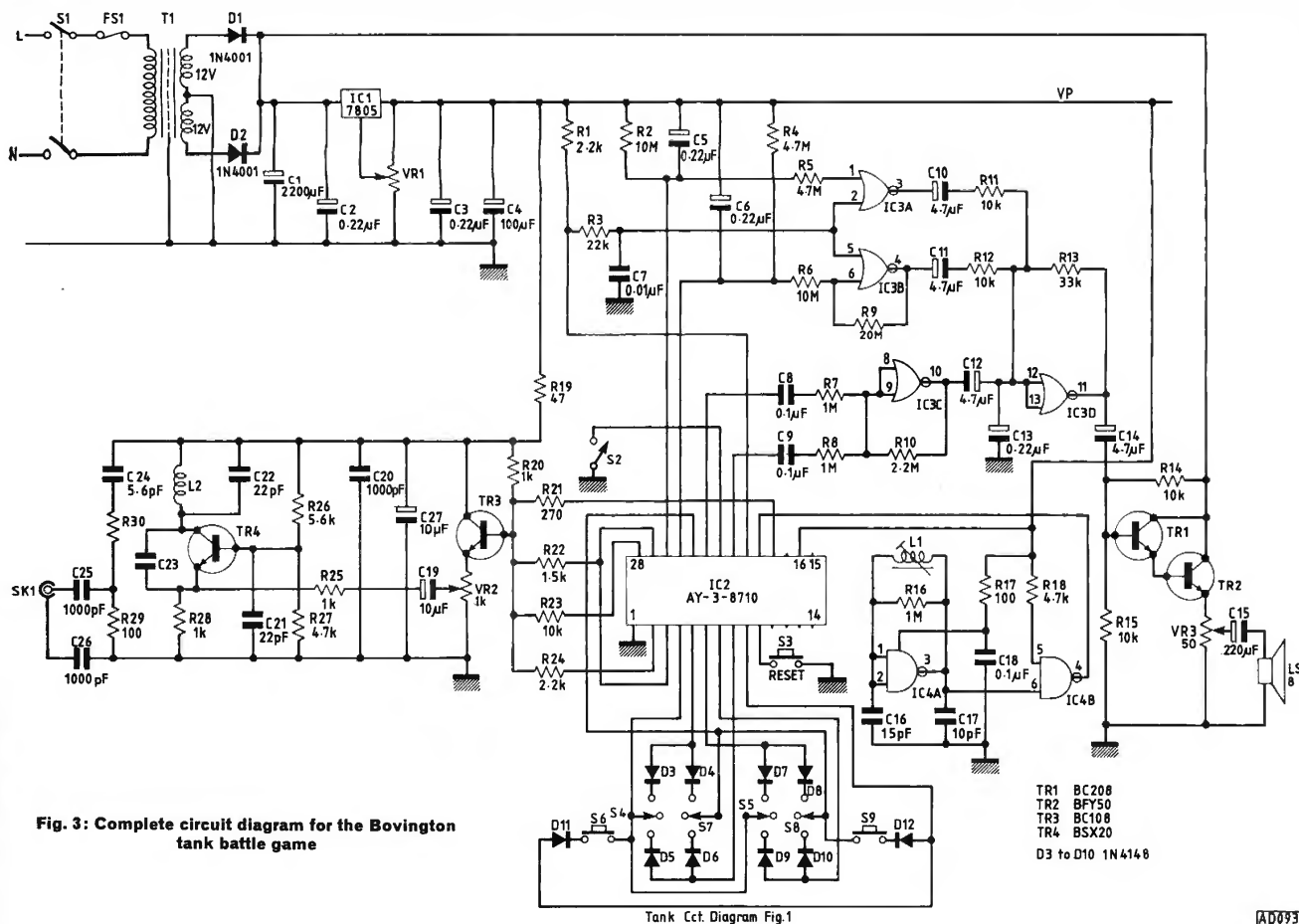
Carefully check the p.c.b. for correct assembly and freedom from inadvertent shorts such as solder



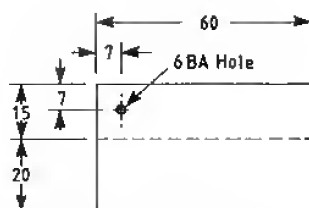
▲
Fig. 1: Front panel drilling diagram

Fig. 2: Main printed circuit board connections ►



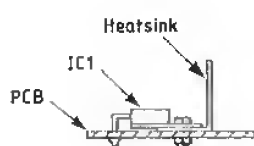


AD093



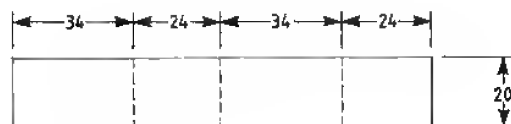
Dimensions in mm.
Material: 16 SWG Aluminium

▲ Fig. 4: Heat sink for IC1

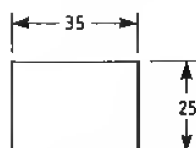


AD096

Fig. 5: Details of modulator screen ►

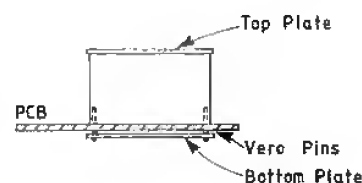


1 off



2 off

Dimensions in mm.
Material: Tinplate.



AD097

bridges, set VR1 fully clockwise and VR2 to midrange and fit the unit in the case with 6BA screws through the fixing holes. Wire the unit up as shown in Fig. 2. Fix two 6 pin DIN sockets in the front of case connected to points G-Q & S on the p.c.b. to feed the hand controllers. These sockets may be omitted and the multicore wires fed through suitable holes fitted

with grommets. The hand controllers can be assembled in any convenient small plastic boxes.

Switch the power on, monitor the voltage VP across C4 and adjust VR1 to obtain 6.5 volts. If you have a scope or counter fit IC4, power up and adjust L1 for 4MHz. If not, set the top of the core of L1 approximately 6mm into the former. Fit the remaining inte-

★ components

Resistors

All $\frac{1}{4}$ W 5%

47 Ω	1	R19
100 Ω	3	R17, 29, 30
270 Ω	1	R21
1k Ω	3	R20, 25, 28
1.5k Ω	1	R22
2.2k Ω	2	R1, 24
4.7k Ω	2	R18, 27
5.6k Ω	1	R26
10k Ω	5	R11, 12, 14, 15, 23
22k Ω	1	R3
33k Ω	1	R13
1M Ω	3	R7, 8, 16
2.2M Ω	1	R10
4.7M Ω	2	R4, 5
10M Ω	4	R2, 6, 9a, 9b

Capacitors

Plate Ceramic

3.3pF	1	C23
5.6pF	1	C24
10pF	1	C17
15pF	1	C16
22pF	2	C21, 22

Disc Ceramic

1000pF	3	C20, 25, 26
0.01 μ F	1	C7
0.1 μ F	3	C8, 9, 18

Polyester

0.22 μ F	2	C2, 3
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Tantalum

0.22 μ F 10V	3	C5, 6, 13
4.7 μ F 10V	4	C10, 11, 12, 14
10 μ F 10V	2	C19, 27
100 μ F 10V	1	C4

Electrolytic

220 μ F 25V	1	C15
2200 μ F 25V	1	C1

Potentiometers

1k Ω Horizontal preset	1	VR2
4.7k Ω Horizontal preset	1	VR1
50 Ω Wirewound	1	VR3

Semiconductors

Diodes

1N4001	2	D1, 2
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Integrated circuits

4001A	1	IC3
4011A	1	IC4
7805 regulator	1	IC1
AY-3-8710	1	IC2

Transistors

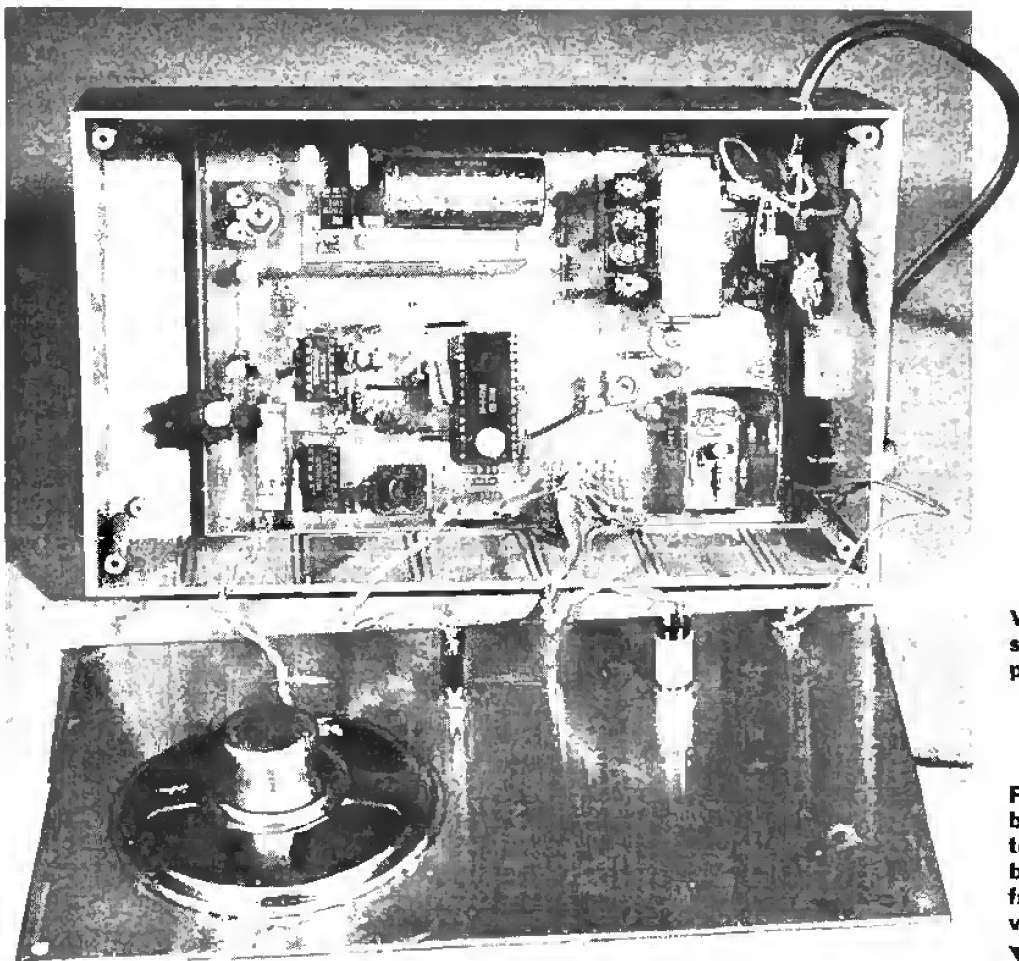
BC108	1	TR3
BC208	1	TR1
BFY50	1	TR2
BSX20	1	TR4

Switches

Paddle s.p.d.t.		
(Arrow CPM3 Black)	2	S4, 5 (Biased to centre off)
Paddle s.p.d.t.		
(Arrow CPM3 White)	2	S7, 8 (Biased to centre off)
Push-button s.p.	3	S3, 6, 9
Toggle s.p.d.t.	1	S2
Toggle d.p.s.t. (Mains)	1	S1

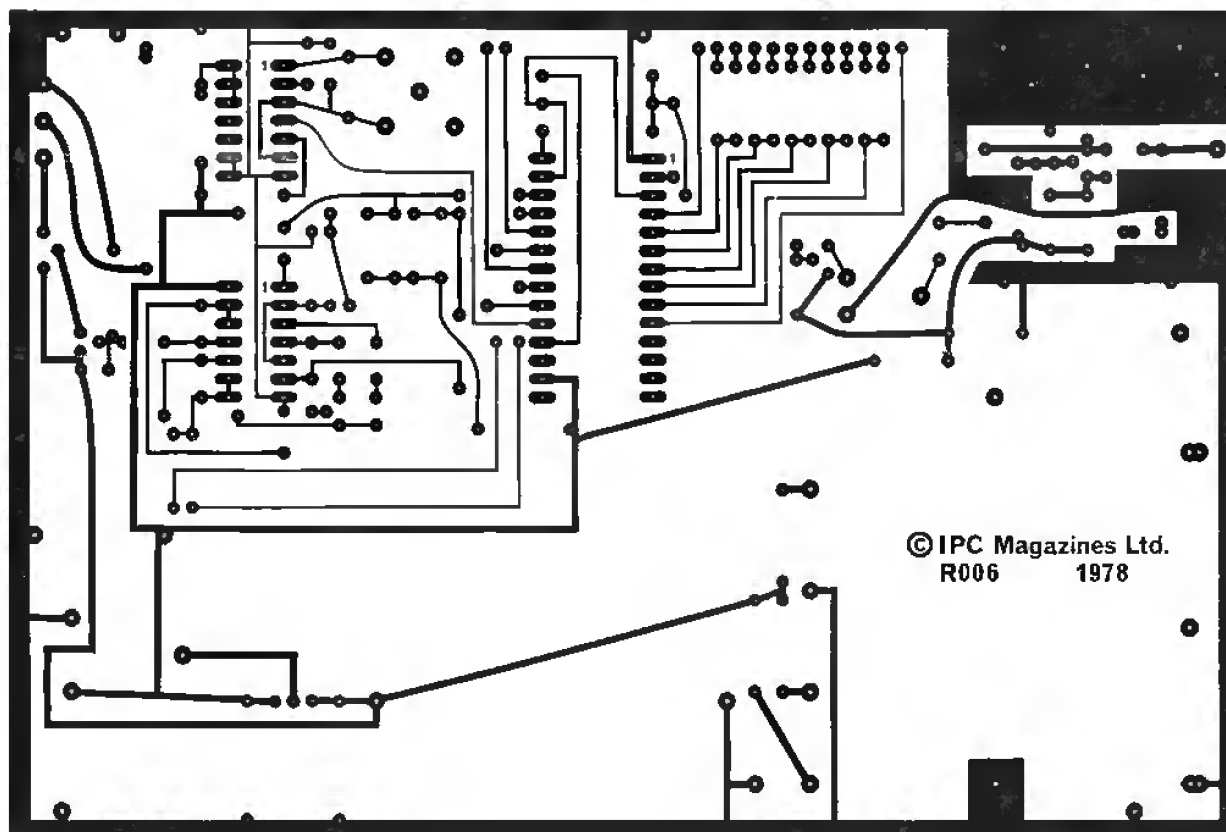
Miscellaneous

Transformer 12V, 12V 250mA MT12 (Marshall's)	
Loudspeaker 2 $\frac{1}{2}$ inch 8 Ω	
Case RS Type 509-608	
Hand control boxes (2) RS Type 509-298	
350mA fuse and holder	
Miniature multicore cable (9-way) 4metres	
Miniature mains cable	
Indicator lamp 12V	
Knob for volume control	
6-way DIN plug and socket (2) Optional for hand control leads.	
TO5 heat sink	
Co-axial TV socket surface mounting type.	
28-way d.i.l. socket (1)	
14-way d.i.l. socket (2)	



View of the internal construction of the main p.c.b. and case

Fig. 6: Printed circuit board copper track pattern. Ready drilled boards are available from Readers PCB Services (see page 68)



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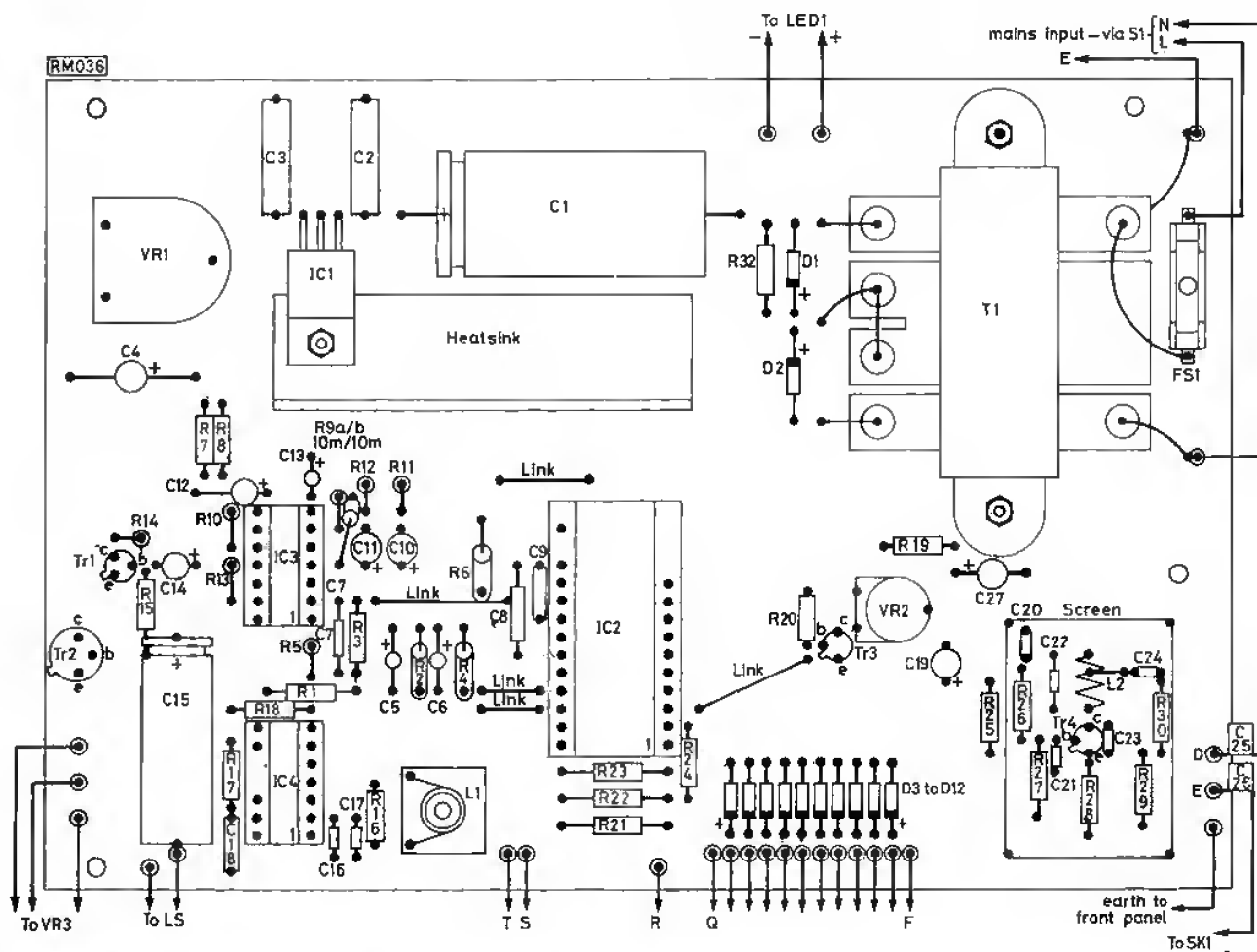


Fig. 7: Main printed circuit board component placement drawing

grated circuits, connect to the aerial input of the television and switch on. Push the reset button, release it and tune the television until a signal from the games unit is found. Several signals may be found, if so choose the best one. L1 may need to be slightly adjusted. When a good picture has been obtained adjust VR2 for the optimum picture, and fit the top cover to the modulator. Check that all the switches function as required and fit the front panel.

Fault Finding

If the unit fails to function check all your construction carefully, then:—

1. Check that the voltage across C4 is 6.5 volts.
2. Vary VP over the range 6 to 7 volts by means of VR1, if this does not help reset it to 6.5 volts.

3. Check with a scope that pin 19 of IC2 has a 4MHz clock input and pin 16 is at 6.5 volts.
4. Check that composite sync is appearing at IC2 pin 18, pushing and releasing the reset.
5. Check for composite video at TR3 base and again at VR2 wiper. If it is appearing at VR2 wiper try again to tune the television to the game signal. If you still cannot get a picture, substitute a new transistor for TR4.
6. If the tanks only go forward under control of the switches you will probably find that one pair of wires to the switches are crossed.

Four Players

Extra excitement and skill can be introduced into the game by splitting the tank controls between four players, two to each tank. The steering controls are operated by the "drivers" while the tank commanders have control of the firing buttons.

The modifications needed to make this a four-player game are very simple, especially if DIN plugs and sockets are used for connecting the control boxes to the main unit. The commander's firing control can be fitted into a simple box wired into the DIN plug. If a duplicate set of controls is not desirable then a permanently fitted "commander's" control can be wired into the game unit with a switch arranged to select either the firing button on the "driver's" box or the button on the "commander's" box.

IC2 Pin Functions

1	Ground
2, 3, 18, 27, 28	Video outputs
4, 5, 6, 7, 8, 9, 24	Control inputs
10	Reset
16	VP (+6.5V)
19	4MHz clock input
20, 21, 23, 25, 26	Sound output
22	Tank trap select
11, 12, 13, 14, 15, 17	Do not connect

examines the player's move in greater depth and responds in 11-16 seconds, while at level three it thinks even more deeply and responds in up to 34 seconds.

Other features include the ability to set up move problems and end games and, the computer never forgets a move. It can verify the position of every piece left on the board at the touch of a key at any stage during the game.

Chess Challenger is available from many different shops and stores throughout the country at £139.95 which includes VAT. However, if no local stockist is available, the company will supply direct by post. *Spectrum Marketing, 12 The Shrubberies, George Lane, South Woodford, London E18 Tel: 01-989 2235.*



KINDLY NOTE!

Active Tone Control, March 1978 page 814
The value of R13, Collector Load for Tr2, should be 10kΩ.

A.M. Receivers, August 1978: Some of the pin connections to the LM380 are incorrect. Pin 3 should read pin 6 (inverting input), pin 4 should read pin 7 (ground), pin 6 should read pin 14 (Vcc), and pin 5 should read pin 8 (V out).

Bovington Tank Battle Game, June 1978

It is possible that problems may be experienced with the 4MHz clock pulse oscillator. If you have difficulty in obtaining a stable picture or obtain multiple pictures of the battleground on the TV screen then the operation of the 4MHz oscillator is probably suspect. If an oscilloscope is available then the output of the oscillator can be checked at pin 4 of IC4. Gently touch the top of IC4 and observe the waveform at Pin 4. If the oscillator stops or the output changes then solder a capacitor of between 27pF and 47pF across the pins of L1. This should cure the problem enabling a stable picture to be obtained.

PW "Jubilee" Electronic Organ, September 1977

Owing to an error in the General Instruments Micro-electronics data book for the year 1976 we have now been officially advised that the power supply connections to pins 8 and 14 of ICs 3 to 6 in the Jubilee organ have been reversed. Fortunately it is unlikely that any damage will have been sustained. In fact very few readers will have experienced any problem because of this transposition, but this is more as a result of luck than for any other reason. It is possible that some readers might have experienced "break up" of one or two notes because of faulty division.

Although your system may appear to be working quite satisfactorily it is not recommended that you permit this fault to go unremedied as no one can be sure what the long term effects might be on the i.c.s involved. Correction is very simple and should be carried out as follows:

1. Break the copper conductor on the underside of the board at the point marked in Fig. 1 and use a piece of tinned copper wire to make a bridge connection to the adjacent copper land.
2. On the upper side of the board remove, or cut through, link wire as shown, and using a short length of insulated wire run a connection from the hole adjacent to pin 8 of IC3 to the board pin nearest C44 of the three that are to the right of IC2.

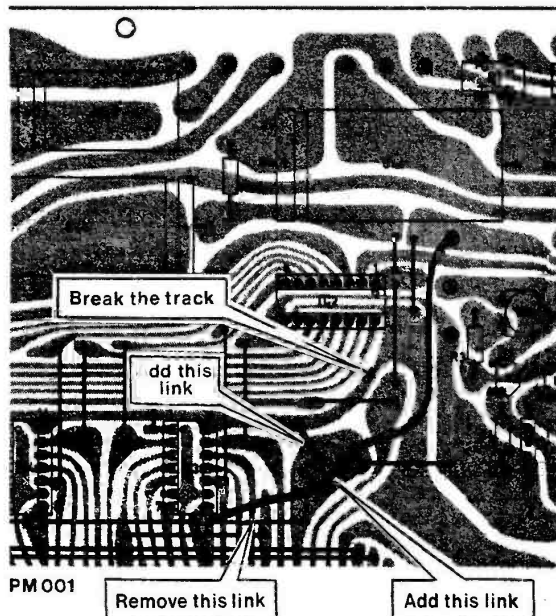


Fig. 1: The area of the p.c.b. to be amended